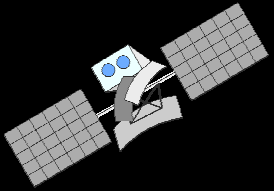


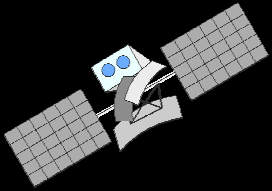


Introduction to GPS



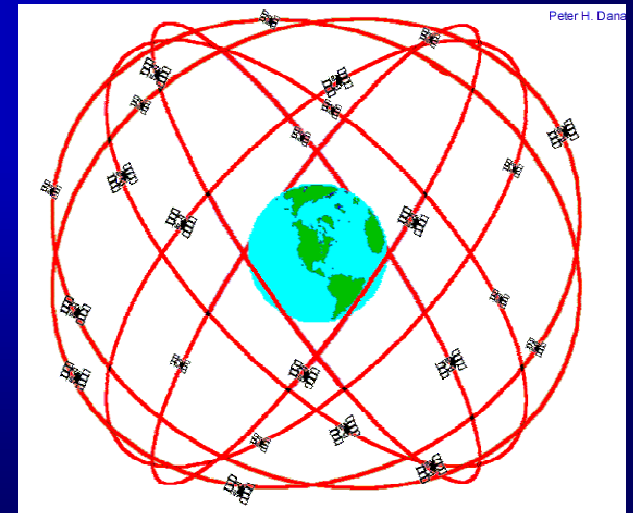
Global Positioning System:

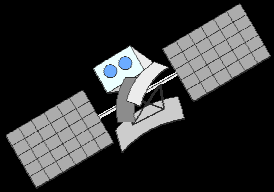
- developed by the US Dept. of Defense
- satellite-based
- designed to provide positioning and timing information:
 - 24 hours/day, 7 days/week
 - under any weather conditions
 - anywhere in the world
- Three components: space, ground, user



1. Space component

- 24 satellites in constellation
- orbit every 12 hours at 11,500 miles
- 4 satellites in each of 6 orbital planes
- transmit a uniquely coded radio signal
- equipped with onboard atomic clock

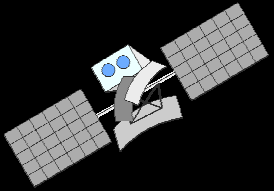




2. Control component

- ground-based monitoring and upload stations
- control orbit and timing information



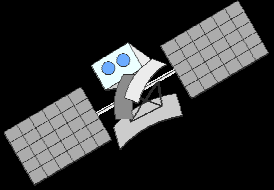


3. User component

- military and civilian users
- navigation and positioning applications on land, sea, in the air and in space

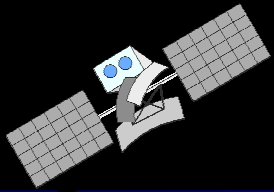


UNH Cooperative Extension 2008



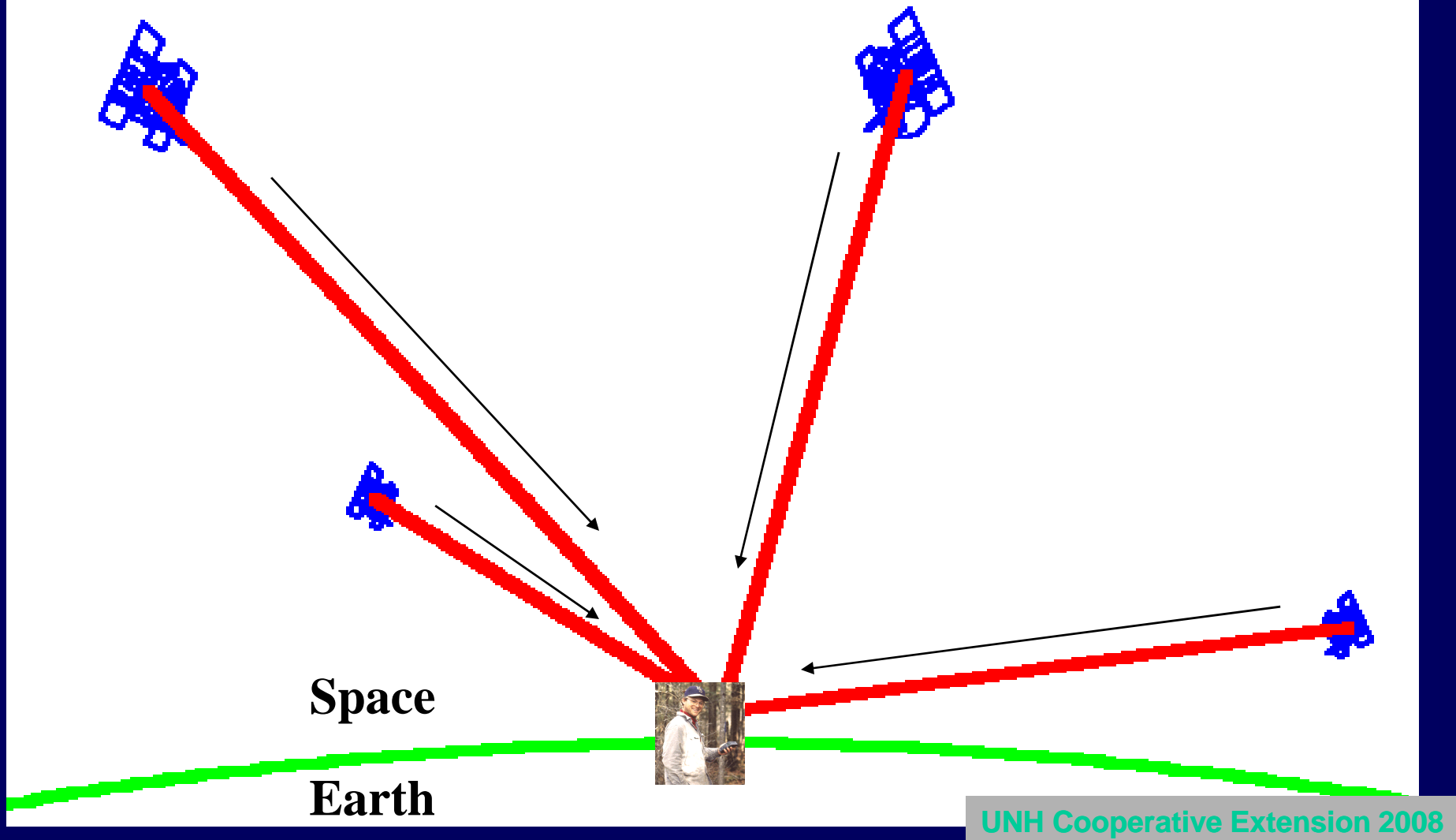
How does GPS work?

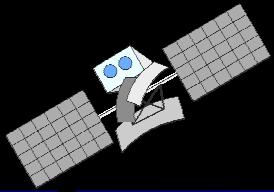
1. the receiver picks up the signals from the satellites
2. uses signal travel time to calculate distance to the satellites
3. triangulates to determine position of the receiver



How does GPS work?

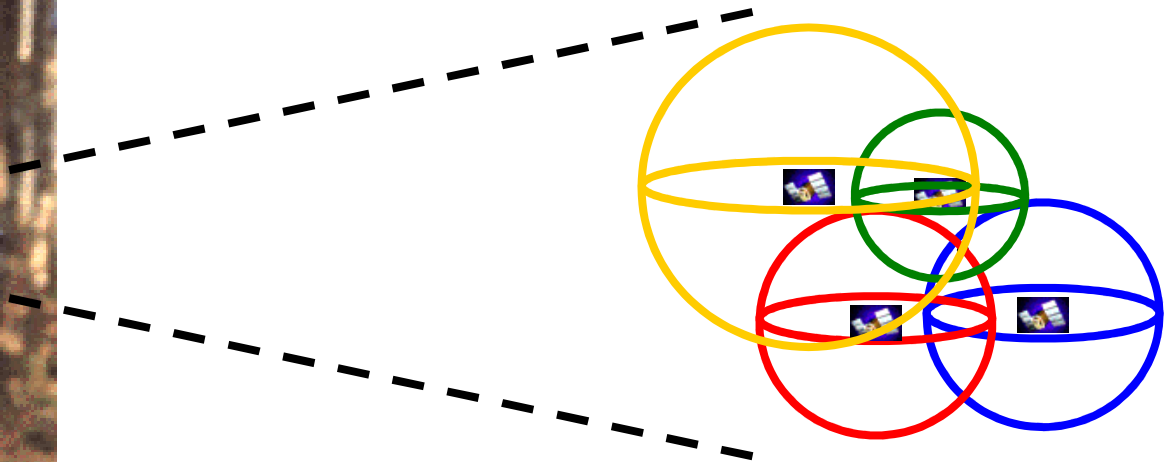
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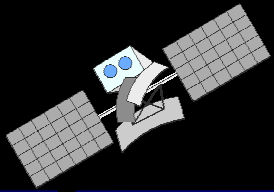




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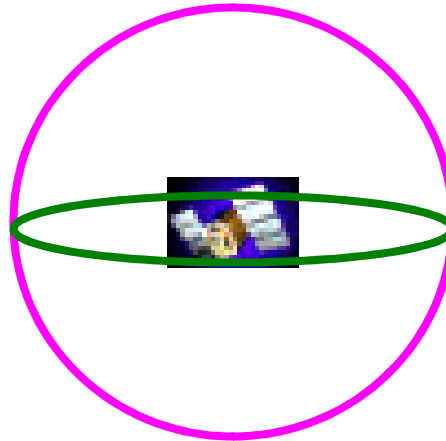
3. Receiver triangulates to determine position of the receiver

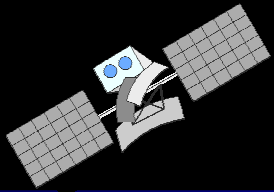




How does GPS work?

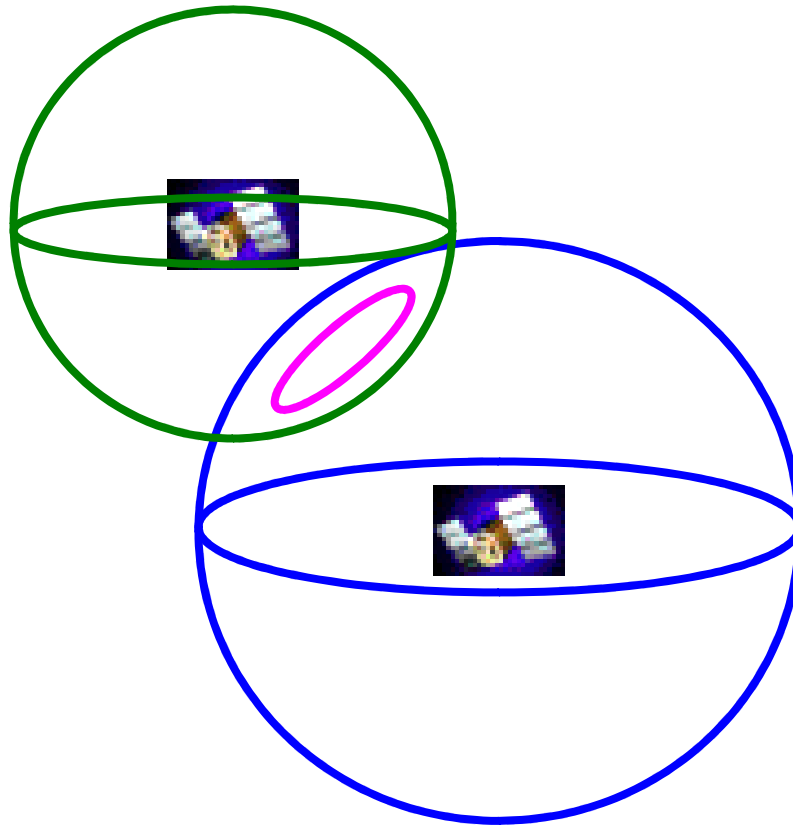
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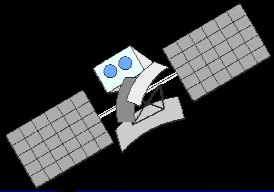




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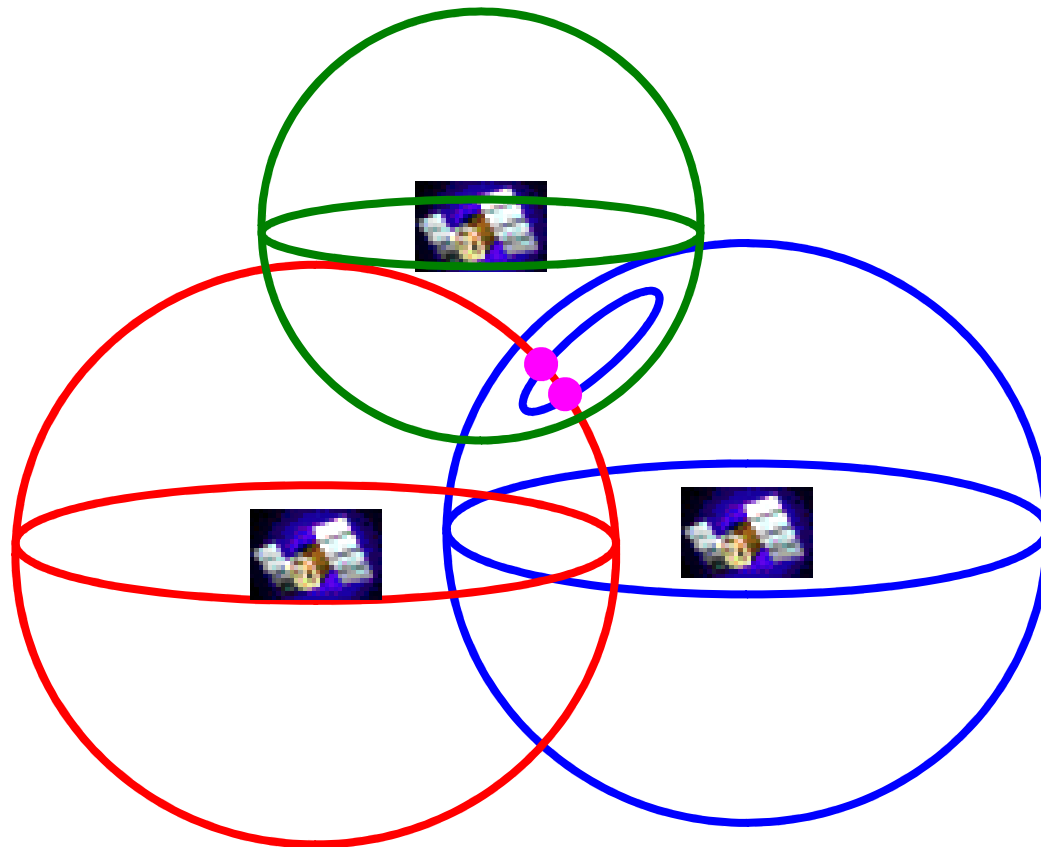
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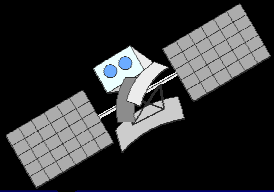




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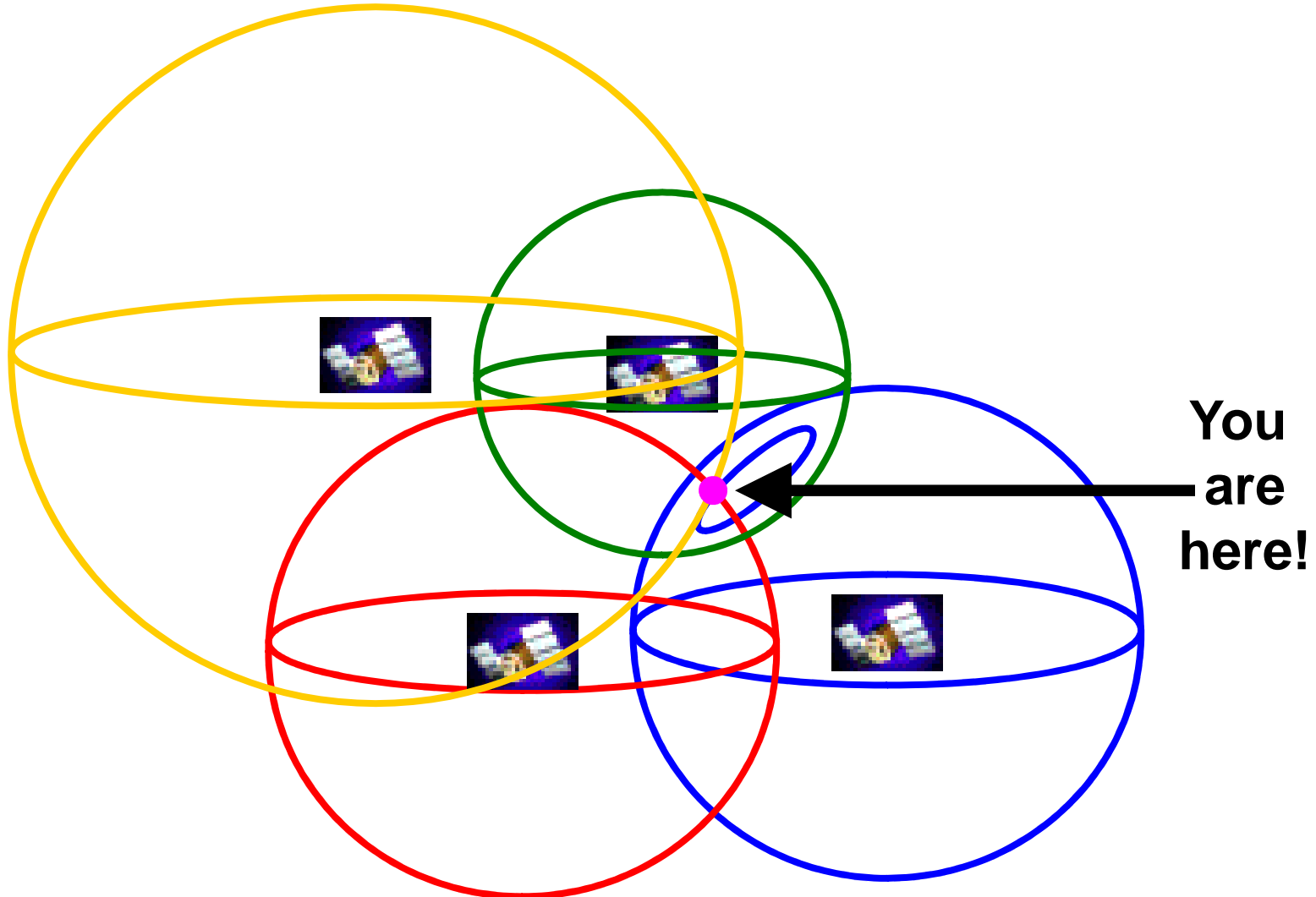
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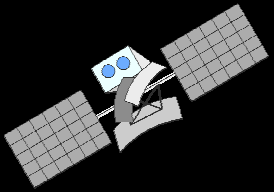




How does GPS work?

3. Receiver triangulates to determine position of the receiver

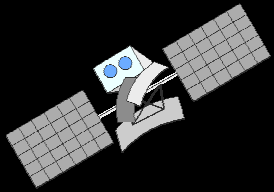




1. Geodetic GPS receivers

- capable of sub-centimeter accuracy
- bulky, expensive
- high-precision applications such as surveying, geodetics

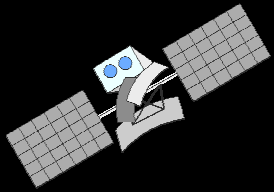




2. Mapping GPS receivers

- capable of 10 meter accuracy (<1 meter with differential)
- light-weight, portable, less expensive
- resource mapping and navigation applications

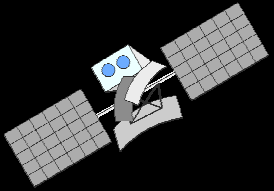




3. Handheld GPS receivers

- capable of 10 meter accuracy (capable of $<3\text{m}$ with differential)
- light-weight, cheap!
- navigation applications and basic mapping applications





Choose your weapon...

1. Geodetic

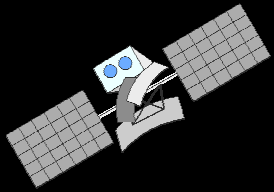
High quality surveying of fixed positions

2. Mapping

Collection of GPS data with large amounts of auxiliary data and strict data quality control

3. Handheld

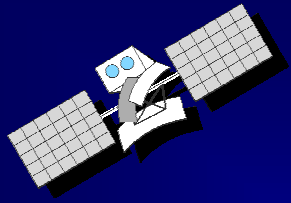
Collection of GPS data with good data quality for more limited budgets



Navigation

*Don't forget your
map and compass!*

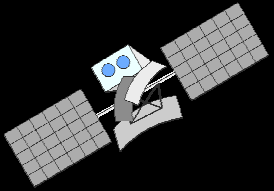




Questions?

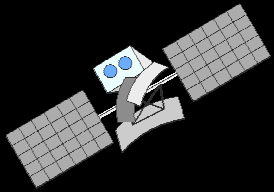


GPS Accuracy



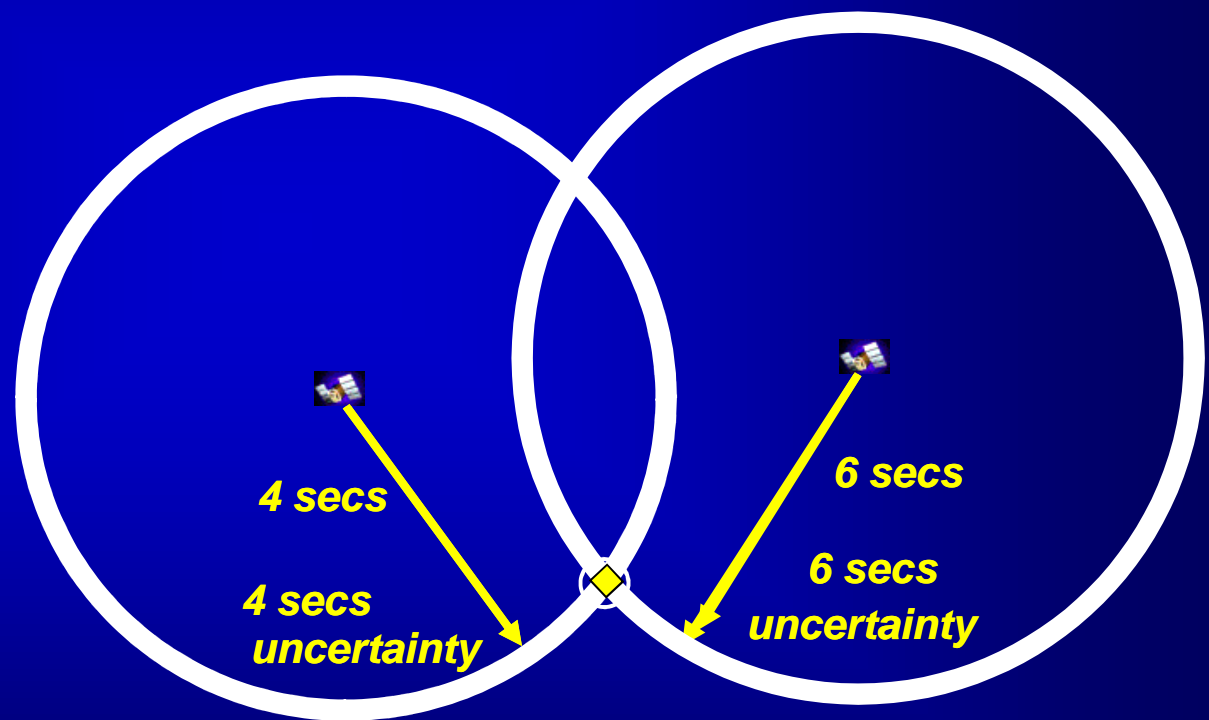
GPS Accuracy: what are your needs?

- **How accurate does your GPS data need to be?**
- **Is vertical accuracy important?**
- **What are the ways to improve accuracy?**

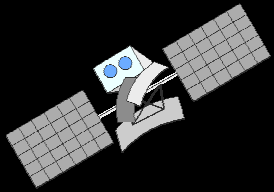


GPS Accuracy: signal delay

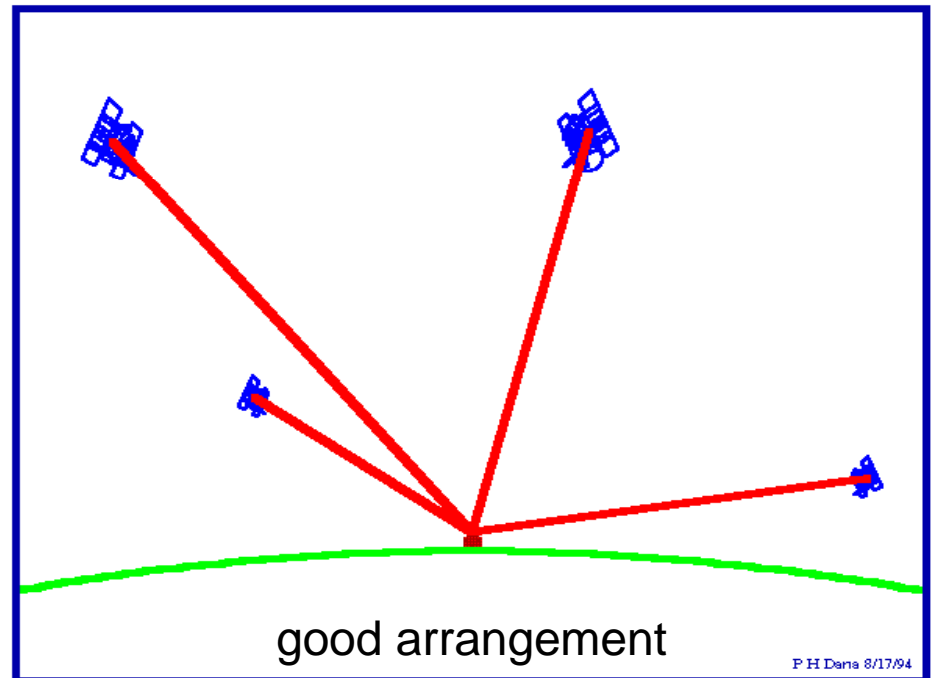
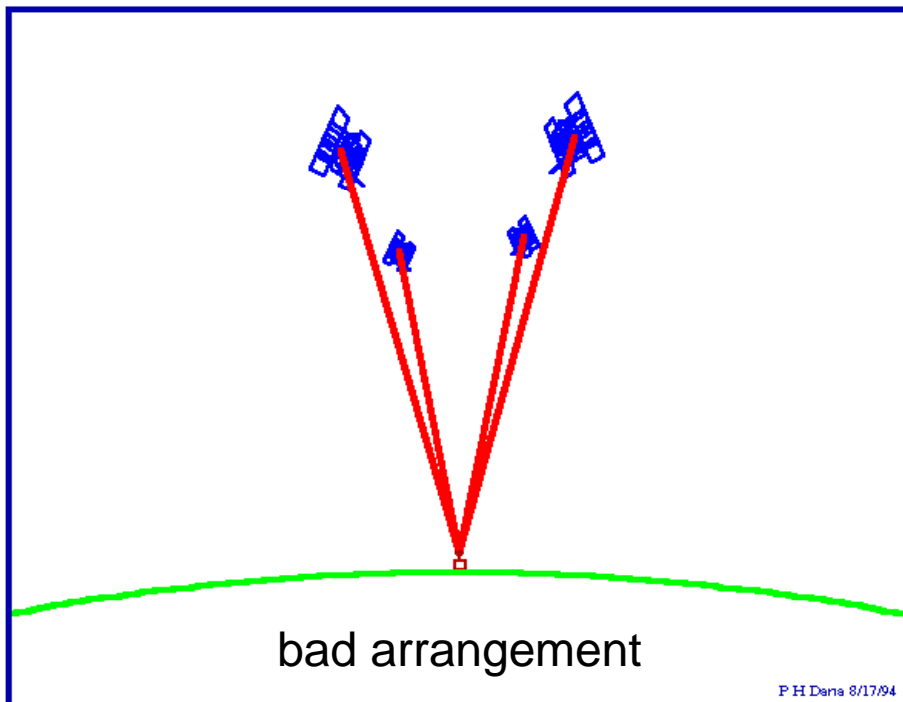
- atmosphere, clock errors, multipath error

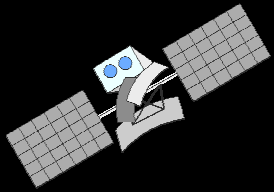


real situation



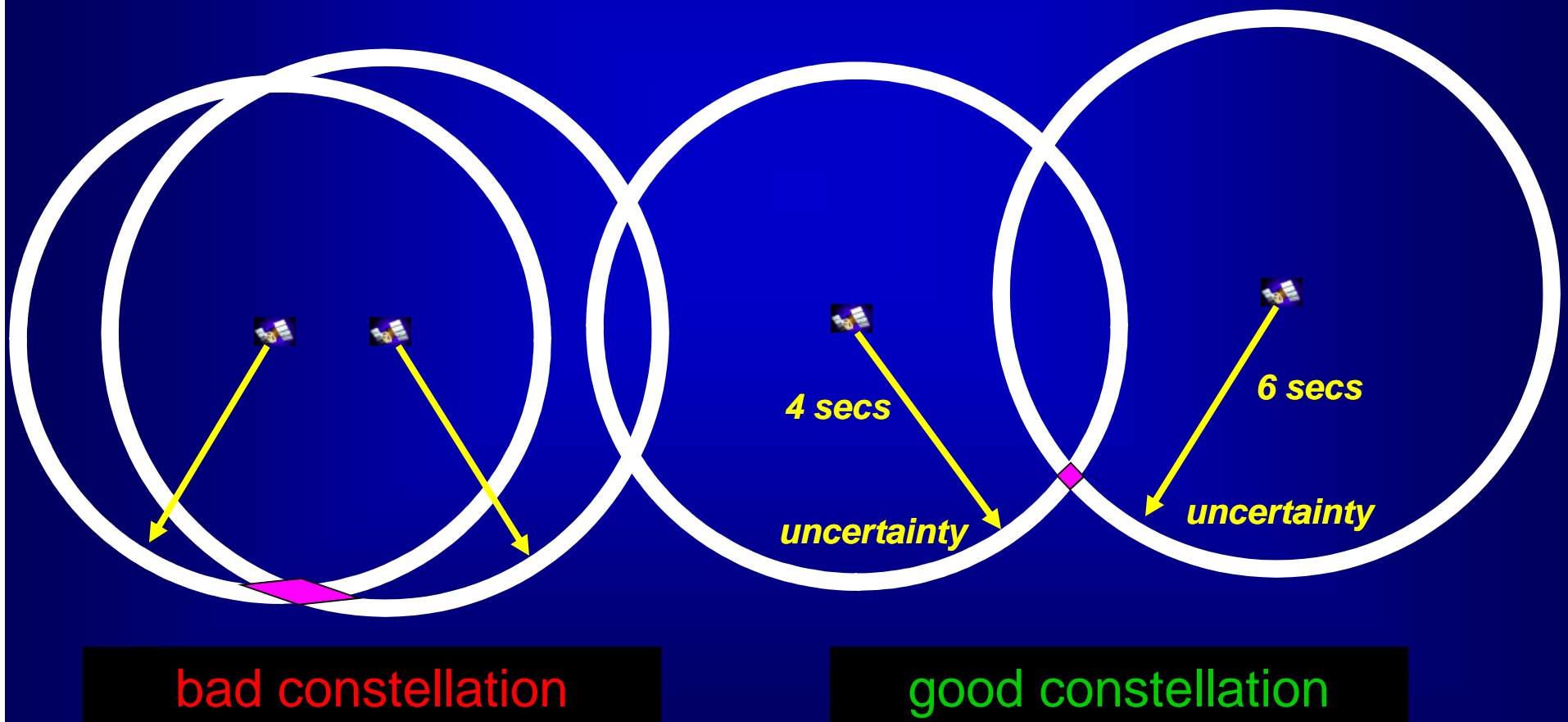
GPS Accuracy: satellite arrangement

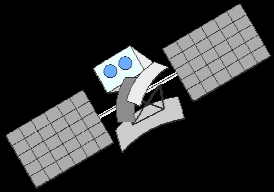




GPS Accuracy: satellite arrangement

- Geometric arrangement of satellites in space

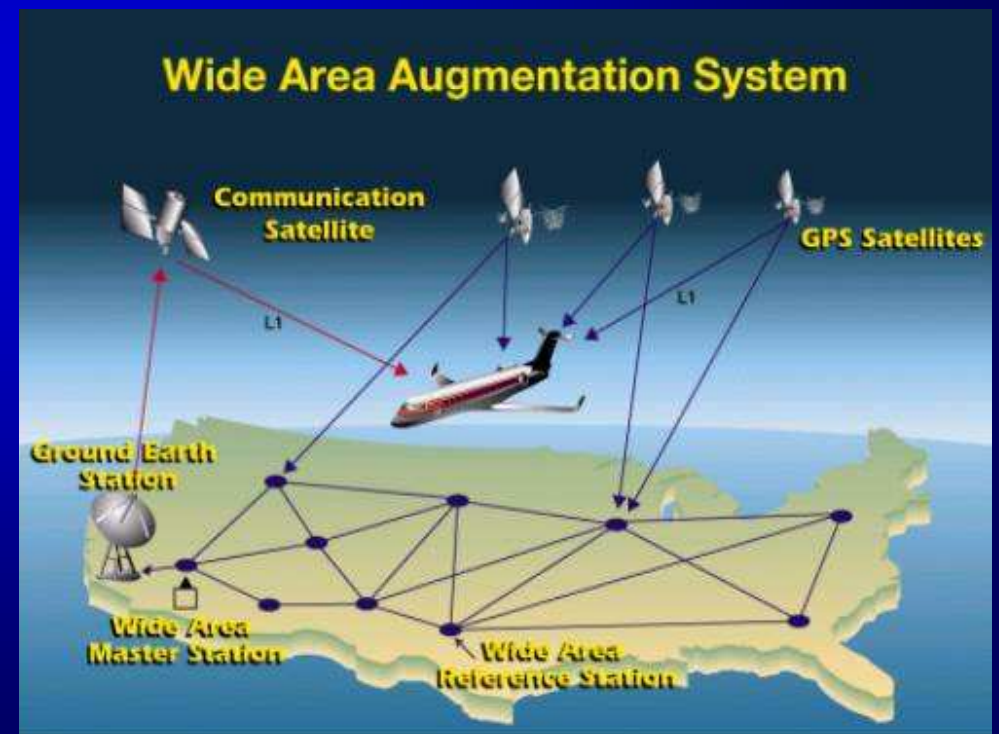


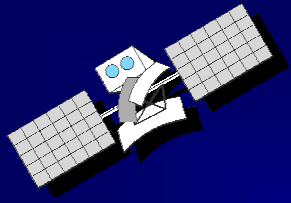


GPS Accuracy: differential correction

- base stations measure inaccuracies and send out correction signal
- 15m: typical handheld GPS accuracy without corrections
- 3m: typical handheld GPS accuracy with corrections
- WAAS: Most common handheld correction

<http://www.ae.utexas.edu/~shep/>

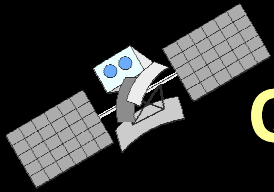




Questions?



GPS Features



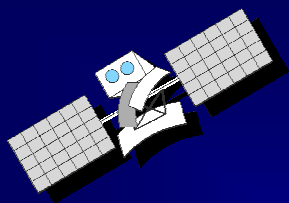
Questions to think about when buying a GPS

- Can you add an external antenna to the GPS?
- Does the GPS have a color screen?
- Can the GPS receive the WAAS signal?
- Is the unit waterproof?
- Does the GPS float?
- Does the GPS have a built-in compass?
- Does the GPS have a built-in altimeter?
- Does the GPS come with background maps?
- How much memory is available for maps?
- How much data can you collect at once?
- Can it connect to a computer?
- What type of connection port does it have?

	Antenna	Screen	Compass	Altimeter	Port	Memory	Waypoints	Track log
GPS 72		Gr			Serial	0 MB	500	2K
\$110								
GPS 76	Ant	Gr			Serial	1 MB	500	2K
\$140								
GPSMap 76	Ant	Gr			Serial	8 MB	1000	10K
\$155								
GPSMap 76S	Ant	Col	Com	Alt	Serial	24 MB	1000	10K
\$175								
GPSMap 76Cx	Ant	Col			Serial/USB	128+ MB	1000	10K
\$265								
GPSMap 76CSx	Ant	Col	Com	Alt	Serial/USB	128+ MB	1000	10K
\$290								

All units have WAAS, are waterproof and float

Prices are based on pricegrabber.com search in Dec 2008



***This GPS presentation includes slides from
Trimble Navigation and Tom Luther, USDA Forest
Service.***